

lumen extending from a proximal end of the tip to a distal end of the tip, and wherein the fiberoptic pressure sensor has a pressure sensing surface, the fiberoptic pressure sensor is embedded in the tip such that the pressure sensing surface is exposed to said pocket.

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16.(amended)A balloon catheter system comprising a fiberoptic sensor catheter and a balloon catheter, said balloon catheter comprising a balloon membrane, a tip having a tip lumen, an outer tube, and an inner tube disposed within an outer surface of said outer tube, said inner tube extending beyond a distal end of the outer tube, the tip being connected to a distal end of the balloon membrane and to a distal end of the inner tube, said fiberoptic sensor catheter comprising a tube having a fiberoptic pressure sensor connected to a distal end, said fiberoptic pressure sensor being connected to a distal end of a fiberoptic fiber which is connected to the tube, said fiberoptic sensor catheter fitting within the inner tube and in the tip lumen.

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18.(amended)An intra-aortic balloon catheter comprising a co-lumen tube, a balloon membrane, an inner lumen extension tube, and a tip, said co-lumen tube having an outer lumen inner surface, defining an outer lumen, and an inner lumen inner surface, defining an inner lumen, said inner lumen having a smaller cross sectional area than said outer lumen, a proximal end of the inner lumen extension tube and a proximal end of the balloon membrane are connected to a distal end of the co-lumen tube, the tip is connected to a distal end of the inner lumen extension tube and to a distal end of the balloon membrane, said tip having an outer surface, an inner surface, defining an inner tip lumen, and a pocket, a fiberoptic sensor is embedded in the tip such that a pressure sensing surface of the fiberoptic sensor is exposed to said pocket.



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Schock, et al.

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CATHETER HAVING A
FIBEROPTIC SENSOR

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ALL PENDING CLAIMS WITH AMENDMENTS INCORPORATED

1.(amended) A balloon catheter comprising a balloon membrane, a tip, a fiberoptic pressure sensor connected to said tip, a fiberoptic fiber, an outer tube, and an inner tube disposed within an outer surface of said outer tube, said inner tube extending beyond a distal end of the outer tube, [a distal end of the balloon membrane being connected to the tip and to a distal end of the inner tube] the tip being connected to a distal end of the balloon membrane and to a distal end of the inner tube, said fiberoptic fiber being connected on a distal end to the fiberoptic pressure sensor.

2. The balloon catheter as claimed in claim 1 wherein the fiberoptic fiber is sandwiched between the inner tube and a thin walled tube disposed over the inner tube.

3.The balloon catheter as claimed in claim 2 wherein the thin walled tube is heat shrunk over the fiberoptic fiber and inner tube.

4.The balloon catheter as claimed in claim 1 wherein the fiberoptic fiber is embedded in the inner tube.

5.The balloon catheter as claimed in claim 1 wherein the

fiberoptic fiber is adhered to an outer surface of the inner tube.

6.The balloon catheter as claimed in claim 1 wherein the inner tube is connected to the outer tube, an inner surface of the outer tube defines an outer lumen, and the fiberoptic fiber has a balloon portion which is disposed within the balloon membrane and an outer tube portion which is disposed within the outer tube, the balloon portion of the fiberoptic fiber is connected to the inner tube, the outer tube portion of the fiberoptic fiber is disposed within the outer lumen.

7.The balloon catheter as claimed in claims 1 or 6 wherein the inner tube is connected to the outer tube and comprises two tubes connected end-to-end.

8.(amended) The balloon catheter as claimed in claim 1 wherein the tip comprises an inner surface, an outer surface, and a pocket, said inner surface defining a tip lumen extending from a proximal end of the tip to a distal end of the tip, and wherein the fiberoptic pressure sensor has a pressure sensing surface, the fiberoptic pressure sensor is embedded in the tip such that the pressure sensing surface is exposed to said pocket.

9.The balloon catheter as claimed in claim 8 wherein the pocket extends from the outer surface of the tip to a point between the inner surface of the tip and the outer surface of the tip.

10.The balloon catheter as claimed in claim 8 wherein the outer surface of the tip comprises a distal sloping portion and wherein the pocket extends from said distal sloping portion to a point between said distal sloping portion and said proximal end of said tip.

11. The balloon catheter as claimed in claim 8 wherein the pocket extends from a point between the inner surface of the tip and the outer surface of the tip to the inner surface of the tip such that it communicates with the inner lumen.

12. The balloon catheter as claimed in claims 8, 9, 10, or 11 wherein the pocket is filled with a protective material.

13. The balloon catheter as claimed in claims 8, 9, 10, or 11 wherein the pocket is filled with a gel.

14. The balloon catheter as claimed in claims 8, 9, 10, or 11 wherein the pocket is sealed by a membrane.

15. The balloon catheter as claimed in claims 8, 9, 10, or wherein the pocket is sealed by the balloon membrane.

16. (amended) A balloon catheter system comprising a fiberoptic sensor catheter and a balloon catheter, said balloon catheter comprising a balloon membrane, a tip having a tip lumen, an outer tube, and an inner tube disposed within an outer surface of said outer tube, said inner tube extending beyond a distal end of the outer tube, the tip being connected to a distal end of the balloon membrane and to a distal end of the inner tube, said fiberoptic sensor catheter comprising a tube having a fiberoptic pressure sensor connected to a distal end, said fiberoptic pressure sensor being connected to a distal end of a fiberoptic fiber which is connected to the tube, said fiberoptic sensor catheter fitting within the inner tube and in the tip lumen.

17. The balloon catheter as claimed in claim 16 wherein the inner tube is connected to the outer tube.

18.(amended) An intra-aortic balloon catheter comprising a co-lumen tube, a balloon membrane, an inner lumen extension tube, and a tip, said co-lumen tube having an outer lumen inner surface, defining an outer lumen, and an inner lumen inner surface, defining an inner lumen, said inner lumen having a smaller cross sectional area than said outer lumen, a proximal end of the inner lumen extension tube and a proximal end of the balloon membrane are connected to a distal end of the co-lumen tube, the tip is connected to a distal end of the inner lumen extension tube and to a distal end of the balloon membrane, said tip having an outer surface, an inner surface, defining an inner tip lumen, and a pocket, a fiberoptic sensor is embedded in the tip such that a pressure sensing surface of the fiberoptic sensor is exposed to said pocket.

19.The intra-aortic balloon catheter as claimed in claim 18 wherein the pocket is filled with a protective material and wherein the pocket is sealed by a membrane.

31.(new) The balloon catheter as claimed in claim 1 wherein the inner tube is co-axial with the outer tube.

32.(new) The balloon catheter as claimed in claim 1 wherein the inner tube is at least partially connected along its length to the outer tube.

33.(new) The balloon catheter as claimed in claim 18 wherein the fiberoptic sensor is a fiberoptic pressure sensor.

34.(new) The balloon catheter as claimed in claim 19 wherein the fiberoptic sensor is a fiberoptic pressure sensor.